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ABSTRACT

This teacher's guide is the grades 7-9 unit for population education developed for the Baltimore public schools. This mini-demography course covers various factors of population growth and change. The activities of the unit focus on seven major concepts: (1) demography provides information for understanding population growth, trends, and changes; (2) the world is involved in a population explosion; (3) world population grows when the birth rate is higher than the death rate; (4) the earth can support only a certain number of people; (5) population is becoming more concentrated in urban areas; (6) the age structure of a population is an important index of population growth; and (7) personal decisions have demographic consequences. Twelve subunits comprise the major unit. Each contains topic, concepts, objectives, activities, materials needed, and conclusions. The units use graphs, charts, and a few statistics. (Author/JR)

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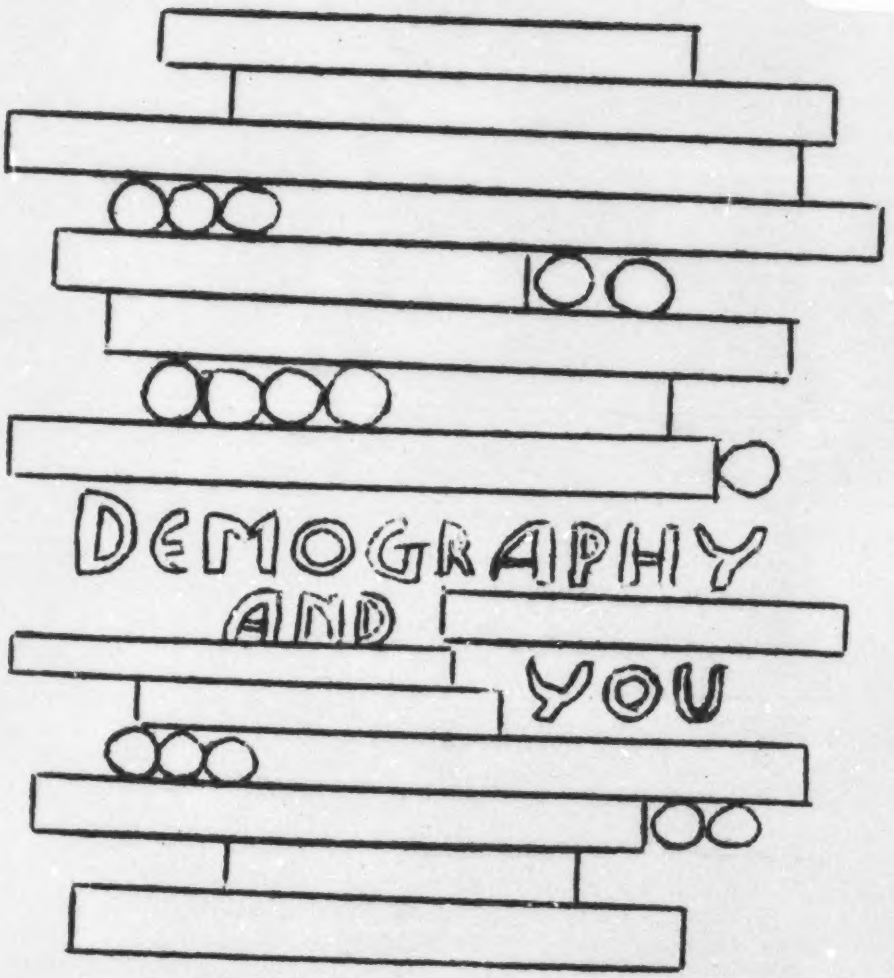

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WHY POPULATION?

Things work funny. An example. Many thousands of years ago, men slumped around barefoot, oomphing and ouching at the little hard things often encountered underfoot. Undoubtedly, other men encountered these hard things in another way - as they fell from overhead. Evenutally someone gave these hard things a name. They were called rocks. And that was that. What more could you need to know - those little hard things often underfoot and sometimes overhead are called rocks. In short, a rock is a rock is a nuisance. But then an amazing thing happened. A man, some man, probably with rocks in his head, began to see rocks differently. Like everyone else, he saw that a rock was hard, but he also saw something new. He saw that hardness made rocks good in that they could be used as tools for cleaning, cutting, pounding, chopping, scraping, powdering, grinding, hoeing, plowing, piercing, clubbing, and God knows what else. Now this whole thing was funny in a way, for rocks had been there before, always been there, it seemed. People had even known rocks were hard, but no one, up until that time, has seen the possibilities.

All this simply goes to say that something can be lying around, waiting to be discovered, right out there in the open, and still not be noticed; that is, until the right ideas come into contact, rub together, and spark a new idea. Sometimes people are just too close to something. All those rocks underfoot and overhead - their very nearness obscured any idea that they could be important. This is a corollary to the old saw, "Sometimes you can't see the forest for the trees."

So what? What does this have to do with population? Well, something similar to what happened with rocks has happened with population. Like rocks, people have been around a long time. The number of people in the world has been growing for thousands of years, because, unlike rocks, people reproduce. That this fact had any great importance or significance was not generally noticed. This information has been lying around, waiting to be understood for many years. And an amazing thing has happened. Things work funny. A man, some man, probably with rocks in his head, also saw what everyone else saw - that population was growing - but he saw something new - that this growth has huge consequences.

Without population growth, man perhaps would still be a wanderer. There would be no cities, no countries, no machines, not much of what we consider today to be human activities. Small groups of men would still be plugging away, unaware that rocks could be made into tools. Without ideas, there would be no tools; without tools, no concentrations of people to dream up cities, art, work, machines, and so on. But like rocks, people have their negative side. Rocks could be made not only into tools, but also into weapons. Growing populations not only developed good things, but also negative things. Growing populations make it more difficult for poor countries to become rich and more difficult for farmers to supply enough food for people to eat. Population growth supplies people, to talk and to love, great new tools to use, medicine, books to read, but growing population also uses up resources, causes psychological hardships, and dirties up rivers. Things work funny.

All this is well and good. We now accept the fact that when we do something, both good and bad result.

But now, someone has noticed something new again. Not only is population growing, but it is growing faster than before. Not only can the number of people grow, unlike the number of rocks, but this growth can actually become faster. Why is this? Because death rates have declined dramatically. The good don't die young anymore, and neither do the bad for that matter. This phenomenon has been given a name - the population explosion. Rocks were given a name too, and for a long time, people thought that was that. Rapid population growth has been given a name too, but whatever one thinks about it, that is not simply that. Whether one is a militant, Zero Population Growth - Now person or a staunch believer in the benefits of rapid population growth, one still has to deal with the consequences of growth. And that is what this unit is about.

GLOSSARY

Age Structure	The percentage of the population in each age category
Birth Rate	The number of births per year per 1,000 population (mid-year)
Carrying Capacity	The maximum sustainable size of the resident population in a given ecosystem
Census	An official enumeration of the total population at a given point in time or during a specific period of time with details as to age, sex, occupation, etc.
Composition	Make-up; structure, constitution of population as to age, race, economic class, etc.
Death Rate	The number of deaths per year per 1,000 population (mid-year)
Demography	The science of vital and social statistics, as of the births, deaths, diseases, marriages, etc., of a population. The study of population - its composition, age structure, and trends
Density	Population size in relation to a unit of space; number of people per unit of space
Distribution	Geographical placement, location, arrangement of population
Emigration	Movement of population out of a given area
Environment	The aggregate of all the external conditions and influences affecting life development and ultimately the survival of an organism
Finite	Having bounds or limits
Growth	Increase in absolute number
Natural Increase	The difference between the annual birth rate and death rate times 100 (to i.e., convert to percentage)

Glossary Continued

Population Growth Rate	Difference between the birth rate plus the rate of in-migration, and the death rate plus the rate of out-migration, (BR + R of in-migration) (DR + R of out-migration)
Implosion	Concentration of population into urban areas
Immigration	Movement of population into a given area
Metropolitan Area	A city and its surrounding suburban areas
Optimum	The best or most favorable
Population	The total number of persons (or units of something, for example, plants) inhabiting a specific area
Population Doubling Time	The number of years it takes for a population to double
Population Explosion	The present rapid growth of world population
Rural	The country as opposed to the city; towns and farms
Suburban	Any district or area lying immediately outside of the city
Urban	Pertaining to a city

Topic I: Population - Demography: Investigating Population Growth, Composition, Trends, and Changes

Concepts:

A. Demography, the study of population, provides information for understanding population growth, composition, trends and changes.

B. Recently, population has begun to grow at a rapid rate, resulting in what has been called the Population Explosion.

C. World population grows when the birth rate is higher than the death rate, (i.e., when the number of births occurring during a specific period of time is greater than the number of deaths occurring during the same period of time.) The population of a country, city, or other areas, grows when the birth rate and rate of in-migration is higher than the death rate and rate of out-migration.

D. The earth can support only a certain number of people At some point, we can assume therefore, there will be zero population growth; that is, population growth cannot continue indefinitely.

E. Presently, population is becoming more concentrated into urban areas - the population implosion.

F. The age structure of a population is an important index of population growth and of the population's ability to meet its resources and economic needs.

G. Personal decisions have demographic consequences (i.e., effects on population growth, density, distribution, and composition).

CONCEPTS AND VOCABULARY

EPISODE	CONCEPTS	VOCABULARY (GENERALIZATIONS)
I	B	population explosion doubling time
II	B	growth rate growt
III	A, B, C	growth growth rate birth rate
IV	A, B, C	death rate
V	A, C	growth growth rate base population (population size) amount, rate exponential growth linear growth
VI	A	migration immigration emigration percentage
VII	A, B, C	GNP
VIII	C, D	carrying capacity environment model
IX	D	optimum carrying capacity
X	E	distribution density: rural, urban, suburban
XI	F, G	age structure productive vs. dependent population census age-sex pyramid
XII	G	projection

EPISODE ONE

Unit: Population - Demography: Investigating Population Growth, Composition, Trends, and Changes

Topic: Setting the Scene - World Population Growth

Objectives: Pupils should be able to identify at least 2 causes of population growth and explain doubling time.

Discussion

This lesson is intended to introduce population growth in an historical perspective and to explore some causes of rapid population growth.

Human population grew very slowly during man's first two million years. As man progressed from hunter and gatherer to herder and farmer (perhaps about 8000 B.C.), population began to grow more rapidly, although still very slowly. This growth was probably the result of man having a larger and more stable food supply. During this period (8000 B.C. to the modern period), man's technology began to develop more rapidly also. By 1650 A.D., there were approximately 500 million people on earth (see graphs for Episode I). By 1850, the population reached about one billion. In the two hundred year period between 1650 and 1850, the world's population had doubled. It doubled again in 80 years, reaching two billion by about 1930. The world's population is expected to be about four billion by 1975, having taken only 45 years to double this time. At present growth rates, world population will again double by about 2010, having taken only 35 years to go from about 3.5 billion people in 1972 to about 7 billion in 2010. (i.e., the increase of population three billion since 1650)

It is this modern rapid population growth which is called the population explosion. Much of this rapid population growth can be correlated with the industrial revolution. Technology has had much impact on population growth by bringing about a decrease in the death rate through increasing the food supply and improving health and sanitation measures.

Whenever you can get the film "World Population" by Perspective Films, use it. It would make an excellent introduction.

Episode One

Getting Ready: Assemble an interest center with population growth in an historical perspective as the focus. Your interest center might look something like this:

Pictures of Primitive Man	Pictures of Changes	Pictures of Modern Man

The idea of this center is to contrast early man and modern man - to provide a visual picture of population growth and to suggest some causes.

Your contribution to the center might include:

- Pictures of man from early man to urban man
- Pictures of primitive villages through modern megalopolis
- Pictures from around the globe - from sparsely populated to densely populated areas
- Pictures suggesting birth and death - juxtaposed
- Pictures of tools from flint to computers, from hoes to modern farm equipment
- Pictures of man the hunter to man the farmer
- Pictures of medicine - primitive to modern
- Graphs of population growth
- Pictures crowded with people to pictures without people
- Appropriate newspaper articles and headlines

Many of the materials for the interest center are included. It is suggested that you supplement these materials with pictures of your own. National Geographic is a good source.

Beginning: Part I - The What (Describing)

Have the class describe exactly what they see in the interest center. Record on the board or on the chart. (Stick simply to description. Have the class avoid interpretation at this point.)

Part II - The Why (Hypothesizing)

Have the class begin to interpret purpose of interest center. Hypothesize as to the connections between the items in the interest center.

Have the class hypothesize as to whether population is growing, declining, or stable.

Have the class give supporting evidence for hypothesis. As the class arrives at an idea of population growth, have them give factors from interest center that would contribute to growth. Much of this evidence is suggested by the interest center (evidences of population growth and reasons - farming, technological advance, advances in health and medicine).

Part III - Checking It Out (Testing the Hypothesis)

Overhead projector - Graph of population growth through the ages

Graph of the population growth 1400-2000

1. Check graphs as to whether growth has occurred. Have the pupils describe and interpret the graph.

2. Check the graphs to see if population growth is correlated with advances in farming, technology, and medicine. (Note slow increase from 8000 B.C. correlated with farming. Note rapid growth from about 1850, correlated with technology, modern farming and modern medicine.)

3. Check the graphs for doubling times (using information from the episode's discussion). Note the length of time it has taken population to double each time and the decreasing time it takes population to double.

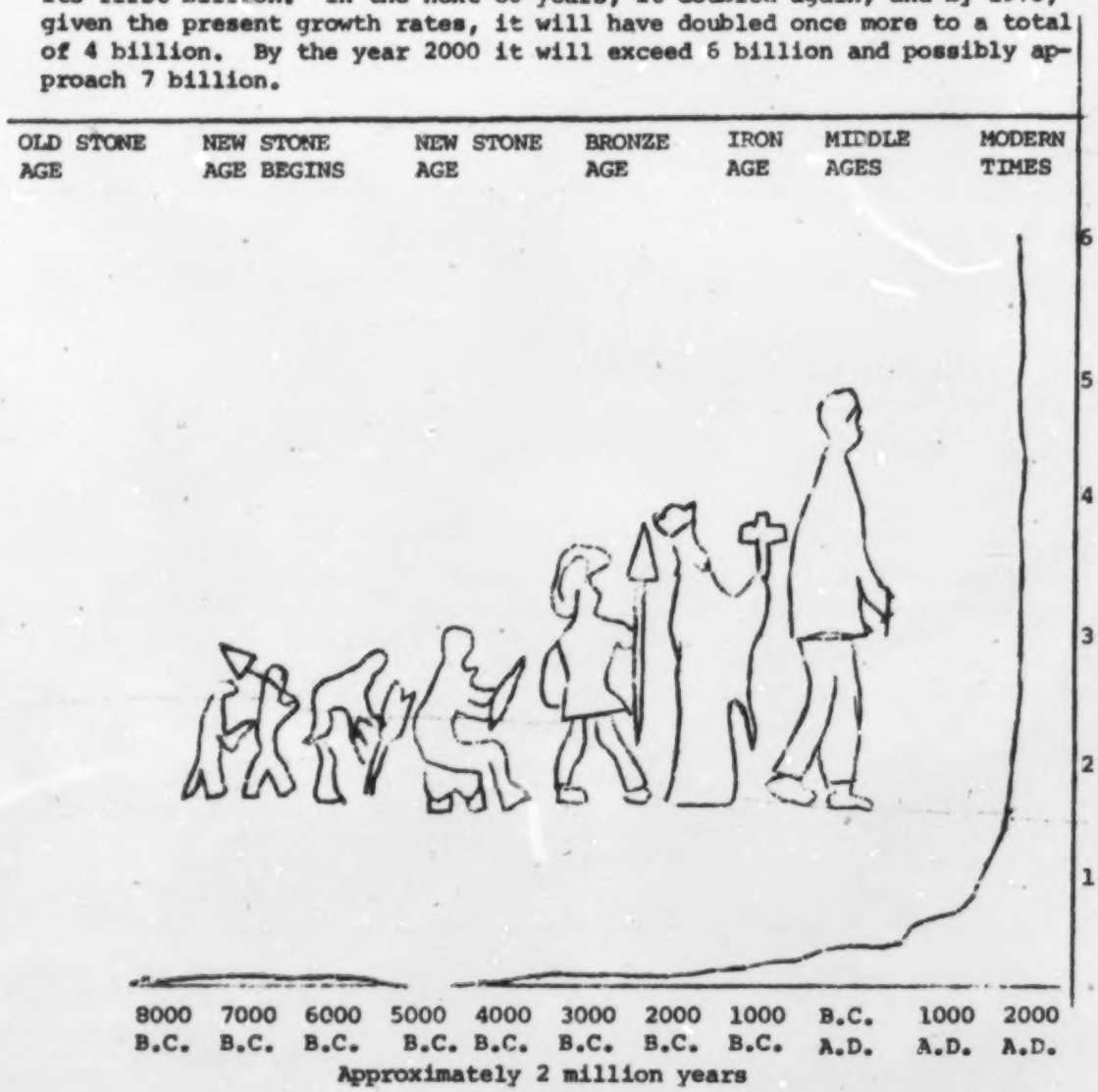
Part IV - Summing It up

Have the pupils verbalize tentative concepts as to population growth and some causes. Record on a chart or on the board.

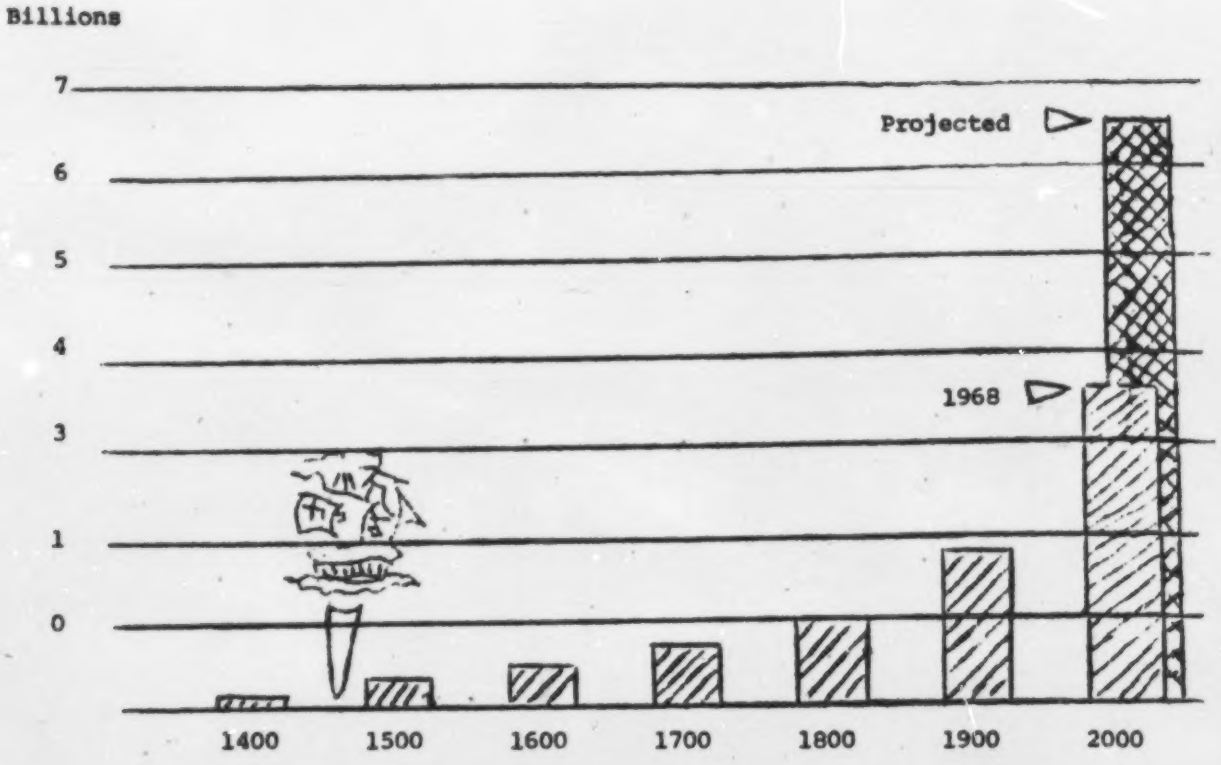
POPULATION GROWTH THROUGH THE AGES

During the hundreds of thousands of years of the Old Stone Age when man was a hunter and a food gatherer, world population probably never exceeded 10 million. Then, sometime between 8000 B.C. and 6000 B.C., man learned to grow his own food, and to create settlements and eventually cities. In the next 8000 to 10,000 years, his population increased fifty-fold, reaching an estimated 500 million by 1650 A.D.

In 200 years, from 1650 to 1850, world population doubled and reached its first billion. In the next 80 years, it doubled again, and by 1975, given the present growth rates, it will have doubled once more to a total of 4 billion. By the year 2000 it will exceed 6 billion and possibly approach 7 billion.



WORLD POPULATION, 1400-2000 A.D.



EPISODE TWO

Unit: Population - Demography: Investigating Population Growth, Composition, Trends, and Changes

Topic: Setting the Scene - U.S., Maryland, and Baltimore - Population Growth

Objective: To graph population growth of the United States, Maryland, and Baltimore City, and to compare the growth of these areas.

Materials:
1. Graph or chart paper
2. Magic markers
3. Yardsticks

Beginning:

Review world population growth through review of doubling time, using yesterday's graph.

Then divide the class into 3 (or 6) groups and assign each group one of the following areas: U.S., Maryland, or Baltimore City. Ask each group to graph the growth of its particular area and to consider its graph in light of the overhead projector graphs of world population growth. Does the graph show geometric growth (⌣) or linear growth (/)? Do graphs agree with students' expectations?

Have the groups present the graphs and observations to the rest of the class. Two discontinuities should make themselves apparent here: 1) Baltimore City shows a decline in population and 2) the United States seems to be growing more slowly than the rest of the world.

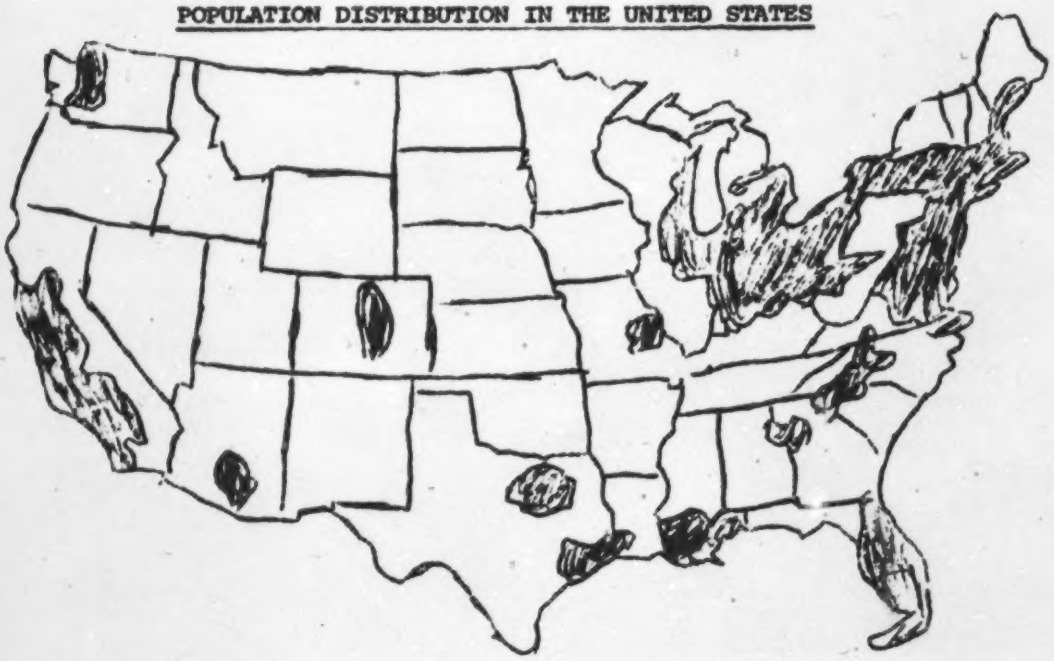
Give students the opportunity to explain the difference between the United States and world population growth rates. The explanations here should be left as open hypotheses.

BALTIMORE CITY POPULATION
(1790-1970)

YEAR	POPULATION (rounded off to nearest thousand)
1790	14,000
1820	63,000
1850	169,000
1880	332,000
1910	558,000
1940	859,000
1950	950,000
1960	939,000
1970	906,000

Note: Population figures are given in 10 year intervals after 1940.

POPULATION DISTRIBUTION IN THE UNITED STATES



The areas that are shaded in show where most people in the U.S. live and where many more people are moving.

MARYLAND POPULATION (1900-1970)

YEAR	POPULATION (rounded off to nearest hundred thousand)
1900	1,200,000
1910	1,300,000
1920	1,400,000
1930	1,600,000
1940	1,800,000
1950	2,300,000
1960	3,100,000
1970	3,900,000

Source: United States Census Bureau

UNITED STATES POPULATION
(1790-1970)

YEAR	POPULATION (rounded off to nearest million)
1790	4,000,000
1800	5,000,000
1810	7,000,000
1820	10,000,000
1830	13,000,000
1840	17,000,000
1850	23,000,000
1860	31,000,000
1870	40,000,000
1880	50,000,000
1890	63,000,000
1900	76,000,000
1910	92,000,000
1920	106,000,000
1930	123,000,000
1940	133,000,000
1950	152,000,000
1960	180,000,000
1970	205,000,000
2000 (estimated)	290,000,000

Source: United States Census Bureau

EPISODE THREE

Unit: Population - Demography: Investigating Population Growth, Composition, Trends, and Changes

Topic: Doing the Demography: Population Growth

Objective: Pupils should be able to define demography, compute population growth and make predictions about population growth.

Materials:
1. "Why Population?" - Ditto
2. "From the Demographer's Point of View" Part I & Part II - Ditto

Discussion

This episode is intended to present another way of looking at population growth - the demographer's point of view.

Demography is the study of population. Demographers compute the growth rate of a particular population by looking at the birth rate and death rate for that population. Growth occurs when the number of births per year is greater than the number of deaths per year. Growth rate (i.e. per 1000 people measured for the mid-year population) equals the birth rate (i.e. births per 1000 people) minus the death rate (i.e., deaths per 1000 people). Note that growth and growth rate are different since growth rate is figured per 1000 people. Example: Dud City has a population of 2000. Its growth rate is 10 per 1000. In one year, therefore, its growth is 20 people since there are two thousand original inhabitants.

Technically, this growth rate should be called the crude growth rate because it does not include the effect of migration on the population. That will be covered in the next episode.

Beginning:

Distribute the sheet "Why Population?". Discuss with the class the main points: the population explosion, the effects of past and present population growth (both good and bad), and man's awareness of the problem.

Then ask the class to isolate the main factors in population growth. You might go about this as follows. From the graphs and readings we've done so far, it is obvious that something has changed with population, that for some reason, population is now growing explosively. I would like you to think for a second what the simplest factors affecting population growth are. In the simplest sense possible, why do we have a population explosion? Read the sheet "From the Demographer's Point of View" Part I, and be ready to discuss this question.

Episode Three

Pupils should suggest births as the simplest factor. Then ask how the students account for the rapid growth of population. "What change has occurred with respect to births to cause a rapid growth rate?" If the students are to be consistent, they will have to suggest that births and the birth rate have risen dramatically. Show the overhead sheet on declining birth rates. How can this be? How can population grow explosively when birth rates have in fact declined?

"Obviously we are faced with a puzzle. It is not the birth rate which is the key factor in rapid population growth. What is it?"

Home Assignment:

Read "From the Demographer's Point of View" Part II.

EPISODE FOUR

Unit: Population - Demography: Investigating Population Growth, Composition, Trends, and Changes

Topic: Doing the Demography - Death Rate and Growth Rate

Objective: Students should be able to distinguish between growth and growth rate and to compute growth rates.

Materials: "From the Demographer's Point of View" Parts II and III (ditto)

Beginning:

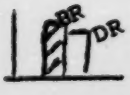
Restate the question from yesterday, "If birth rates have declined, why is there rapid population growth? What has caused this change, this new occurrence in man's history?"

Answer: Falling death rates.

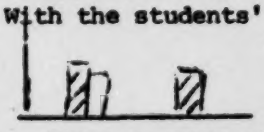
Ask the students to explain how this causes a population explosion. Ask the students to use the term growth rate and explain its meaning in terms of a formula, i.e. growth rate = birth rate - death rate.

Ask the students to show this visually somehow. Example: "If this is the birth rate in the year 400 A.D. what would the death rate be?"

Students' addition would make the graph look like this:



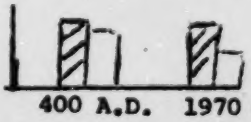
That is, birth rate is only a little greater than death rate. Refer back to the overhead graphs. "What would the birth rate for 1970 look like on this graph?" With the students' addition, the graph would now look like this:



400 A.D. 1970 A.D.

That is, birth rate is somewhat lower than in 400 A.D. "What would the death rate look like?"

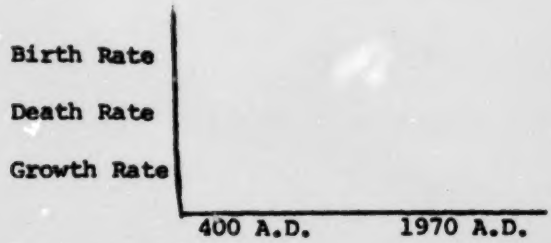
Answer:



400 A.D. 1970 A.D.

That is, about half the death rate. Growth rate is the difference between the two columns. If you would like, you might use a line graph also in place of the bar graph. (Next page)

Episode Four



(Shows decline in birth rate, large decline in death rate.)

Show the overhead projector graph of actual world birth and death rates. (You might like to note effects of wars.) Review the causes of population explosion in relationship to lower death rates.

Home Assignment:

Have the students read "From the Demographer's Point of View" Part III. Main aim - to distinguish between growth, growth rate, and population size as aspects of population growth.

EPISODE FIVE

Unit: Population - Demography: Investigating Population Growth, Composition, Trends, and Changes

Topic: Doing the Demograph - The Population Explosion

Objective: Students should be able to compute growth and explain the effect of base population size on growth.

Materials: 1. "The Population Explosion" Ditto
2. Graph pattern (individual sheets)

Beginning:

Have the pupils to complete these two equations and definition.

Growth - _____ - _____
(Rate of natural increase)

Growth Rate = _____ - _____
(Crude)

Rate means _____

Then give out the sheet "The Population Explosion". Complete the analogy. Just as the number of people making noise as well as the rate at which they make the noise, affects the amount of noise, the size of a population is as important as its rate of growth in terms of its effect on population growth.

Give the example of two populations, both having growth rates of 2%. Suppose population A is 100,000 and population B is 1,000,000. Now figure the growth for each. Obviously population B has a greater amount of growth and a greater set of demands to meet than population A, even though both are growing at the same rate.

Show the overhead of world growth again. "Suppose the growth rate were to remain steady for thirty years. Why would the growth twenty five years from now be much greater than now?" Because the base population size would be much larger. All those new people don't just stand around tugging on their ears. They get right in here and contribute their two per cent's worth.

To nail down this point, introduce terms exponential (or geometric) growth and linear (or arithmetic) growth.

"Observe as I give you two growth patterns. Of the two, which pattern is more similar to that of world population growth?" (Give the numbers one at a time in order that the students will have some opportunity to figure out the patterns.)

Episode Five

		I	II	III	IV	V	VI	VII	VIII	IX	X
Pattern #1:	100	110	120	130	140	150	160	170	180	190	200
Pattern #2:	100	110	121	133	146	161	177	195	215	237	261

The students may or may not seem confused. Ask the class what remains constant in each pattern. It is obvious that in Pattern #1, the amount added each day is constant at 10 per "year" (i.e., the growth is constant). Note: there is a large difference in the number at the end of the tenth "year". What was the total growth under Pattern #1? 100. Under Pattern #2? 161.

Have the students graph each pattern. It will then become clear that Pattern #2 is similar to the pattern for world population growth. Apply the term "linear" (or arithmetic) growth to Pattern #1; that is, a constant amount is added each day.

Apply the term "exponential" (or geometric) growth to Pattern #2 and population growth; that is, the base number is multiplied by some number.

Why is population growth exponential? Each larger generation multiplies the growth by having its own children at more than a replacement rate.

*Numbers under percentage pattern are rounded off to the nearest whole.

Episode Five

THE POPULATION EXPLOSION

In order to understand the population explosion - rapid population growth - we have so far looked only at the growth rate of world population. We discussed doubling time as a product of the growth rate. But the population explosion is not just about fast growth rates; it is about huge numbers of people, millions and billions. Let's look at the billions for a moment.

It was not until about 1820 that world population reached a billion. In short, it took man at least 2 million years to reach his first billion. By 1920, however, world population had reached two billion. The second billion was added in only 100 years. The third billion was added in only 40 years. By 1960, world population was three billion. By 1975, we will have our fourth billion, the last billion people being added in only fifteen years. Now the question may well arise, "How come it takes so little time to add a billion people to the earth's population now?

"Because the death rate has fallen and has thereby led to an increase in the rate of population growth," you say.

Yes, but does that explain it all? An analogy. If you have a stadium full of people and have them all yell at the rate of once every hour (which, by the way, is just about how often something exciting happens in a baseball game), they will certainly make a lot more noise than ten bicyclists blowing their whistles at the rate of once every hour. Now obviously both groups are making noise at the same rate, but just as obviously, no one would claim that the volume of noise was equal. The bicyclists could even blow their whistles at a much higher rate, say sixty times an hour without coming anywhere near the volume of noise produced by the stadium crowd. So what do ten noisy bicyclists have to do with the population explosion? I.... I don't quite remember. I sort of got confused as I was writing this. You figure it out.

EPISODE SIX

Unit: Population - Demography: Investigating Population Growth, Composition, Trends, and Changes

Topic: Doing the Demography - Migration

Objective: The students should be able to define emigration and immigration and compute growth including effect of migration.

Material: Chalk

Discussion

This lesson introduces the other variable in population growth -- migration. Obviously migration has no effect on world population growth since there is no place for earthlings to migrate from or to. However, for sub-global areas, such as countries and cities, migration is a significant factor in population growth. For example, in 1973, the U.S. birth rate was 15.6 while the death rate was 9.4 However the growth rate was 8 per thousand (usually growth rates are expressed in per cent, i.e., .8% growth rate). Since the birth rate minus the death rate accounted for a growth rate of 6.2 per thousand, the other 1.8 per thousand was contributed by a surplus of immigrants over emigrants. With migration taken into account, the formula for growth rate is: growth rate = (birth rate + immigration rate) - death rate + emigration rate)

In short, total those coming into the society (by birth or immigration) and subtract from that those leaving (by death and emigration) to get the growth for the society.

In 1970, Maryland had a birth rate of 18.7 per thousand and a death rate of 8.2 per thousand. Its growth rate was 1.6% (or 16 per thousand). Migration thus had a net contribution of 5.5 people per thousand to Maryland's growth rate, i.e., about 1/3 of Maryland's growth was due to migration. (You might refer back to this during episode on distribution.)

Beginning:

Give the students these figures::

U.S.:	Birth rate (1973)	15.6 per 1000
	Death rate (1973)	9.4 per 1000
	Growth rate (1973)	8.0 per 1000
Maryland:	Birth rate (1970	18.7 per 1000
	Death rate (1970)	8.2 per 1000
	Growth rate (1970)	16.0 per 1000
World:	Birth rate (1973	33.0 per 1000
	Death rate (1973	13.0 per 1000
	Growth rate (1973)	20.0 per 1000

Ask the students to use the formula to check GR = BR - DR

Episode Six

"Why does the formula work in figuring the world population growth rate but not in figuring the U.S. and Maryland population growth rates?"

The students should eventually come up with migration as the answer and should be able to explain why migration does not affect world population.

Clarify the terms immigration (in-migration) and emigration (out-migration).

Ask the students to come up with workable formula for figuring the U.S. and Maryland growth rates. Growth rate = (birth rate + immigration rate)

Give the students figures for mythical towns and have them figure growth and growth rate.

Far City - Population 1000

Birth rate	35 per 1000
Immigration rate	5 per 1000
Death rate	15 per 1000
Emigration rate	3 per 1000
Growth rate	22 per 1000
Growth (new people)	22

Scarce City - Population 10,000

Birth rate	22 per 1000
Immigration rate	1 per 1000
Death rate	11 per 1000
Emigration rate	6 per 1000
Growth rate	6 per 1000
Growth	60*

Be sure to clarify the difference between growth and growth rate.

Grow City - Population 5,000

Birth rate	45 per 1000
Immigration rate	3 per 1000
Death rate	25 per 1000
Emigration rate	3 per 1000
Growth rate	20 per 1000
Growth	100

Paw City - Population 20,000

Birth rate	17 per 1000
Immigration rate	2 per 1000
Death rate	10 per 1000
Emigration rate	4 per 1000
Growth rate	5 per 1000
Growth	100

Cow City - Population 5,000

Birth rate	16 per 1000
Immigration rate	1 per 1000
Death rate	12 per 1000
Emigration rate	8 per 1000
Growth rate	-3 per 1000
Growth	-15 .....

(City is losing population)

EPISODE SEVEN

Unit: Population - Demography: Investigating Population Growth, Composition, Trends and Changes

Topic: Doing the Demography - Population Data Sheet

Objective: Information

Material: "World Population Data Sheet" - Population Reference Bureau

Beginning:

Divide the class into eight groups and give each a "World Population Data sheet" from the Population Reference Bureau.

This episode is informal in nature, intended to give the students a look at the world birth, death, and growth rates and to give them a chance to get an idea of the magnitude and scope of world population growth.

As a guide or focusing device, the students should be asked to find the following information:

1. Highest birth rate (give rate and country)
2. Lowest birth rate
3. Highest death rate
4. Lowest death rate
5. Highest growth rate
6. Lowest growth rate
7. Countries with over 100 million people
8. Present world population
9. Projected world population for 1985
10. Country with highest Gross Natural Product (GNP)
11. Country with second highest GNP

1 (What countries would you expect to be showing significant rises in GNP?)

12. What relationship exists between growth rate and GNP?
13. How long will it take Syria's population to double? India's? Sweden's? The U.S.? Nigeria's?
14. What relationship exists between growth rate and population over 64? Why? Which would have an older population - Algeria or Japan?
15. What continent shows the highest growth rate?
16. Other items of interest.

EPISODE EIGHT

Unit: Population - Demography: Investigating Population Growth, Composition, Trends and Changes

Topic: A Continuing Activity - A Model for observing and manipulating population growth

Objective: Pupils should be able to construct a display using data interpreted from graphs, arithmetic computation, and predicted growth.

Materials:
1. bottle tops or other uniform objects
2. aquarium
3. flat box
4. toothpicks
5. matchboxes or substitute

Discussion

This activity involves setting up a model for investigating population growth in relationship to the carrying capacity of the environment. The constant in this model is an aquarium from which an analogy is drawn with earth (specifically their fixed sizes.) The only variables are birth and death rates as migration does not affect the world's population. This model allows the class to observe and graph a population explosion, to see how population growth multiplies itself by providing an ever larger population for the growth rate to act on. The model also gives the students a chance to observe the different growth rates and/or seek solutions to the problem of overrunning the environment's carrying capacity. It is suggested that you do the follow-through activity number three, also.

Activity:

The term environment is introduced and applied to the box or aquarium. Bottle tops are introduced as symbols for people (or other living things). Aquarium is introduced as analogous to earth, specifically the biosphere, and life beyond the aquarium is understood as impossible (no air, food, etc.)

Episode Eight

Four bottle tops are introduced (i.e. 2 "families") A growth rate is established (e.g. 3 "children" per "family", 1 "death" per "family" per day). Births mean new bottle tops are added; deaths mean bottle tops are removed. Each day may be thought of as a ten or twenty year period, if desired.

Day #1 - 6 "births", 2 "deaths"
birth rate 1500/1000 per day (i.e. 1500 births per 1000 population)
death rate 500/1000 per day (500 deaths per 1000)

growth rate 100% (1000 new people per 1000)
absolute growth 1st day = 4 population = 8
(number of new people)

Day #2 - growth rate remains same throughout
growth = 8 population = 16

Day #3 - growth = 16 population = 32

Day #4 - growth = 32 population = 64

Day #5 - growth = 64 population = 128

etc.

Growth continues until population reaches carrying capacity and bottle tops begin falling out of aquarium (i.e. People die because biosphere can no longer support them - no air, food, etc. left for new people.)

Continue analogy with earth and its carrying capacity.

Following Through:

1. Compute days required to reach carrying capacity and try the same experiment with lower and higher growth rates and compute lengths of time to each carrying capacity.

2. Try to find solutions (pupils may suggest equalling out birth and death rates); a larger container will not be allowed.

3. Try the same experiment using a flat box as the environment, "food" and "housing". For example, each bottle top might need one toothpick to eat each day and a match box house for every four people (bottle tops). Capacity would be reached when there is no longer any room to "grow" toothpicks (this growing could be done by placing toothpicks side by side to represent a crop needing space to grow) and matchboxes start falling when placed on top of each other

EPISODE NINE

Unit: Population - Demography: Investigating Population Growth, Composition, Trends, and Changes

Topic: Carrying Capacity and Optimum POpulation

Objective: Pupils should be able to define "carrying capacity" and "optimum"

Materials: 1. picture: telephone booth stuffing
2. house plan sheet

Discussion

This lesson introduces and explores two concepts which are at the heart of the population debate. Both are a challenge to the notion that growth is good and inevitable. The carrying capacity of of an environment can be measured in terms of the maximum population supportable and sustainable by the environment. As an example, suppose a given area can supply one hundred people with just enough food to live. Its carrying capacity, then, is one hundred people. Suppose, however, one hundred ten people inhabited the area. One of two things could happen. First, those persons not getting enough food would die. (Note: Given our example in which each of the one hundred people was getting only enough to live, it would not be possible to divide the food any further. Obviously, then, the problem would be who and how many people would get the minimum.)

Secondly, the one hundred ten people might somehow be able to grow more food. However, the area can only support and sustain the food needs of one hundred people. Growing more food would then begin to destroy the environment, using up the soil's ability to produce. Soon, then, the area would no longer be able to support even one hundred people. The Dust Bowl is an example of environmental overload in which the productive capacity of the land was destroyed. Luckily, however, people could move elsewhere and the United States could grow enough food without using the Dust Bowl land. By letting the land lie fallow and planting trees as windbreaks, the U.S. was able to restore the land to productive use. Obviously, this is not possible on a world level. If the world's environment is overloaded and its productivity destroyed, there is no other place to move while the environment renews itself.

Carrying capacity, then, is a concept of balance, balance between population and environment. This balance is natural for animals. If there isn't enough food to support a given animal population, then many of the animals simply die from starvation. Unlike people, animals are not able to alter the environment so as to provide themselves with more food. Only people have the ability to alter the environment to the point that it cannot support life. On the other hand, only people have the ability to understand carrying capacity and achieve a balance which does not require starvation as the method for keeping that balance.

Finally, the carrying capacity of a given environment depends on what one defines as necessary for the population. Obviously, if the population's need is defined as merely enough food to exist, then the carrying capacity of the world is much greater than it would be if the population's need were defined as enough food to constitute a healthy diet. As the question of population passes from mere survival to questions of quality of life, the concept passes from carrying capacity to optimum population. Optimum population is the most desirable population for a given environment. Optimum population might be thought of as an environment's carrying capacity given some value other than mere survival. Carrying capacity, then, refers to the ultimate limit of population size. Optimum population refers to any idea of best population size short of the limit. It might be worth noting here that it is estimated that about two-thirds of the world's present population is either undernourished or malnourished.

Beginning:

Telephone booth stuffing picture: introduce the term "carrying capacity" (most people a given area can support).

Then define and discuss optimum population of the telephone booth (most desirable number of people; optimum will probably be one).

Discuss carrying capacity of the class room (although exact figure unknown, room can hold only a certain volume and/or weight; room size does not change, therefore limited, finite carrying capacity).

Have the class discuss what they think would be optimum population of the classroom and give reasons. Discuss effect of values on optimum population (values determine one's idea of optimum population).

Continuing: House Plan Sheet

Discuss and have students do plans. Discuss questions at the bottom of the sheet.

Now, make comparison on board or chart between earth on the one hand and telephone booth, room, and house on the other (Similarity - all have fixed, limited, and finite size; difference - unlike booth, room, and house, you can't leave earth to live somewhere else).

Apply the term "carrying capacity" to Earth. Why is carrying capacity limited? (Earth is finite; therefore resources, food, etc. are limited.)

Discuss "optimum population". How is this different from carrying capacity? List values students hold for people that would make optimum population different from carrying capacity. (Healthy diet, good house, education, etc.) You might have a debate

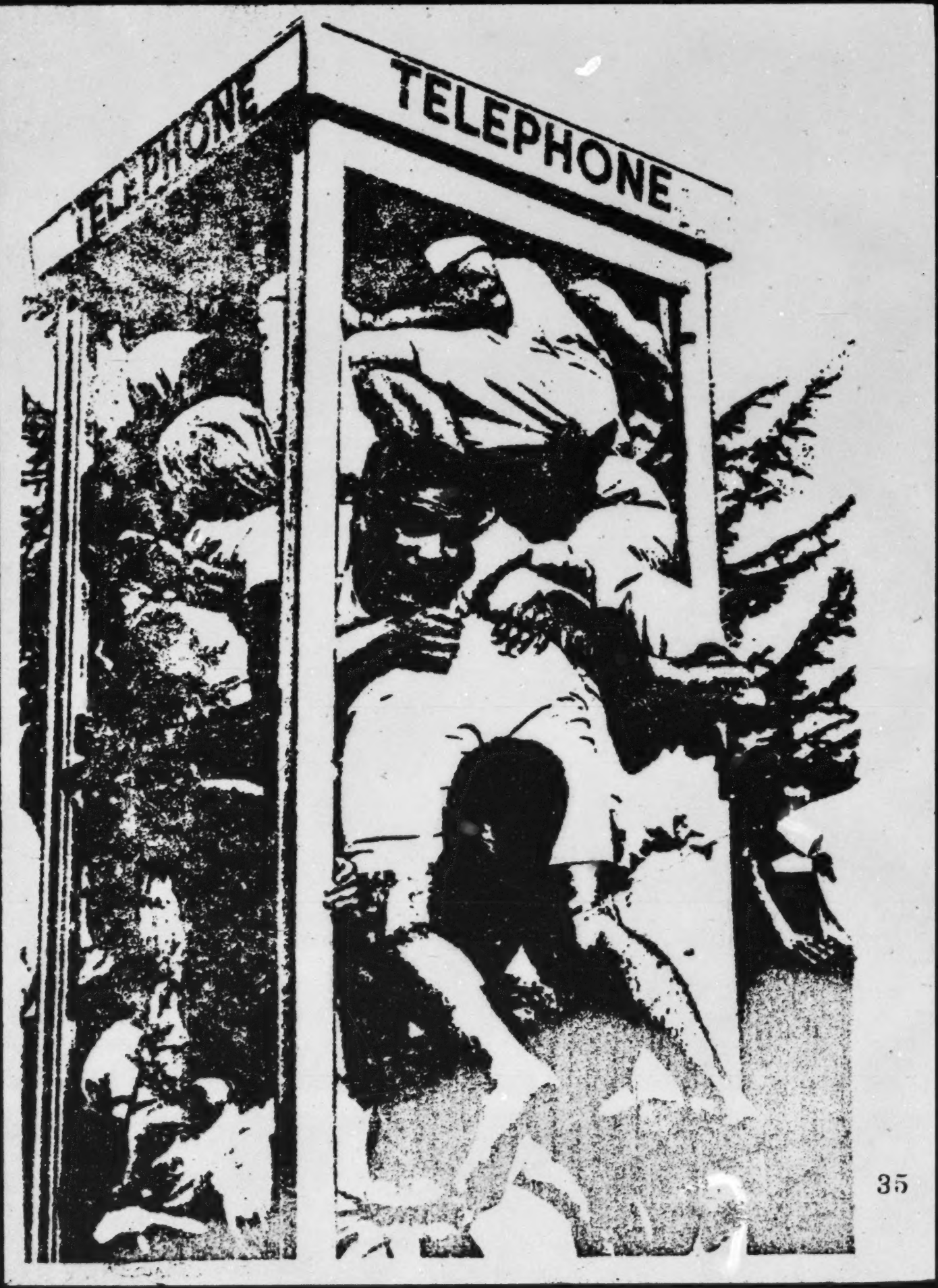
among students as to what people really should have - physically, economically, psychologically, and environmentally.

Have the students read "What It's Like To Be Underdeveloped" by Robert L. Heibroner. Discuss in terms of carrying capacity and optimum population. What do these words mean in human terms?

WORLD POPULATION

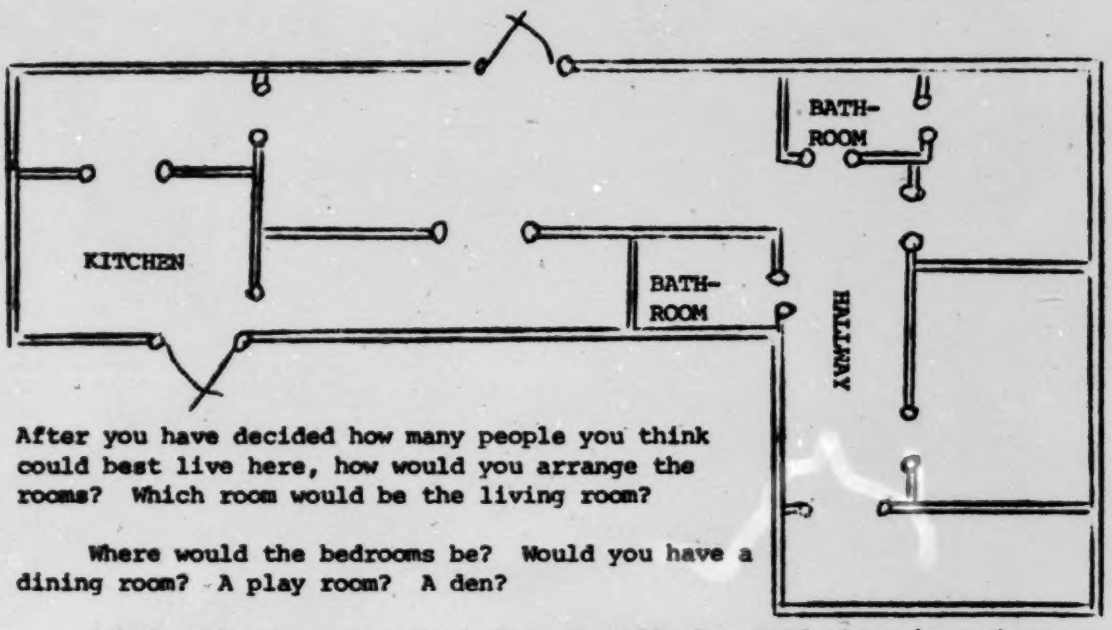
Area	1971	(Estimated) 2000
World	3,700	6,500
Asia	2,100	3,800
Europe	407	370
USSR	250	330
Africa	350	320
North America	230	330
Latin America	290	650
Oceania	20	35

The figures above are shown in billions, millions and thousands.


TELEPHONE
TELEPHONE

CARRYING CAPACITY & OPTIMUM POPULATION

Here is the plan of a house. What do you think would be optimum population of this house? In other words, what do you think would be the best number of people to live in this house?

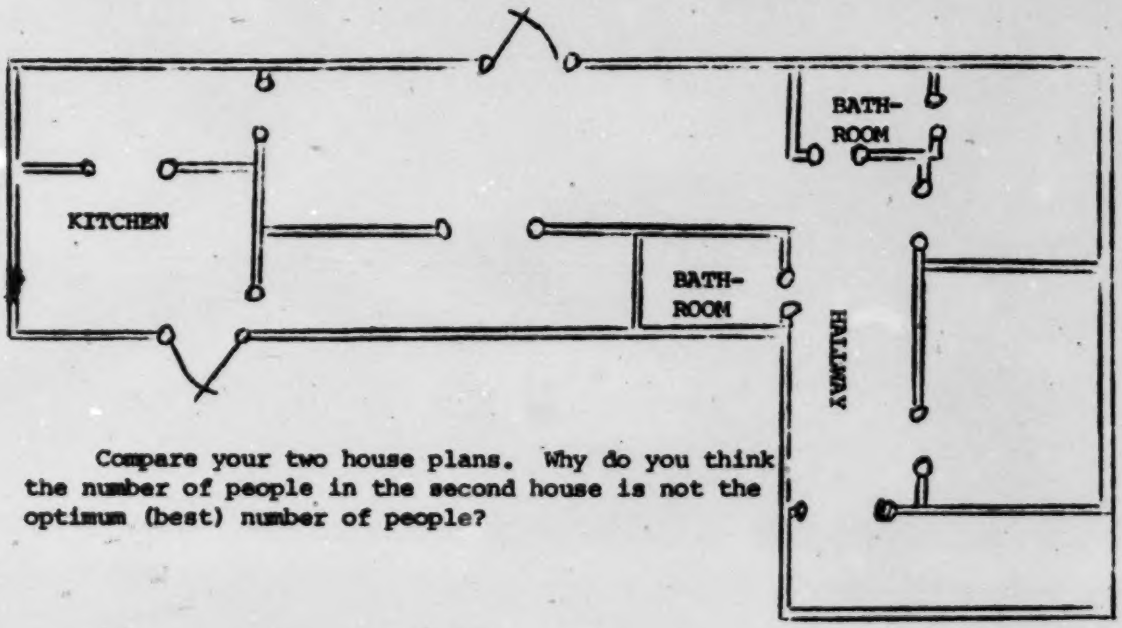


After you have decided how many people you think could best live here, how would you arrange the rooms? Which room would be the living room?

Where would the bedrooms be? Would you have a dining room? A play room? A den?

Label each room. For the bedrooms, tell who would sleep in each one. Draw in furniture in each room. What would you have in each room?

Now, suppose three more people moved in. How would you have to change the rooms to take care of three more people? On the house plan below, show how you would change your house now. Who would sleep where?



Compare your two house plans. Why do you think the number of people in the second house is not the optimum (best) number of people?

EPISODE TEN

Unit: Population - Demography: Investigating Population Growth, Composition, Trends, and Changes

Topic: Doing the Demography - Distribution

Objective: Pupils should be able to define "distribution" and identify at least 3 possible reasons for the current distribution of the population of the United States.

Materials:
1. graph paper
2. chart paper
3. toothpicks
4. world map
5. almanac
6. The Urbanizing United States (1800-1970)

Discussion

This episode focuses on distribution, especially in terms of the class. Basically, the United States' Population is concentrated into urban areas. About 70% of the people live on 2% of the land, mainly along the east and west coasts and the Great Lakes. In 1920, on the other hand, only 51% of the people lived in urban areas. It is this change in distribution (urbanization) which this episode covers and applies directly to students.

Beginning:

Introduce the terms urban and rural and have pupils apply them to cities and suburbs (urban) and pictures of farms and small towns (rural).

Class Survey - Find the number of class members born in urban Baltimore and the number born in other places. Find some figures for parents.

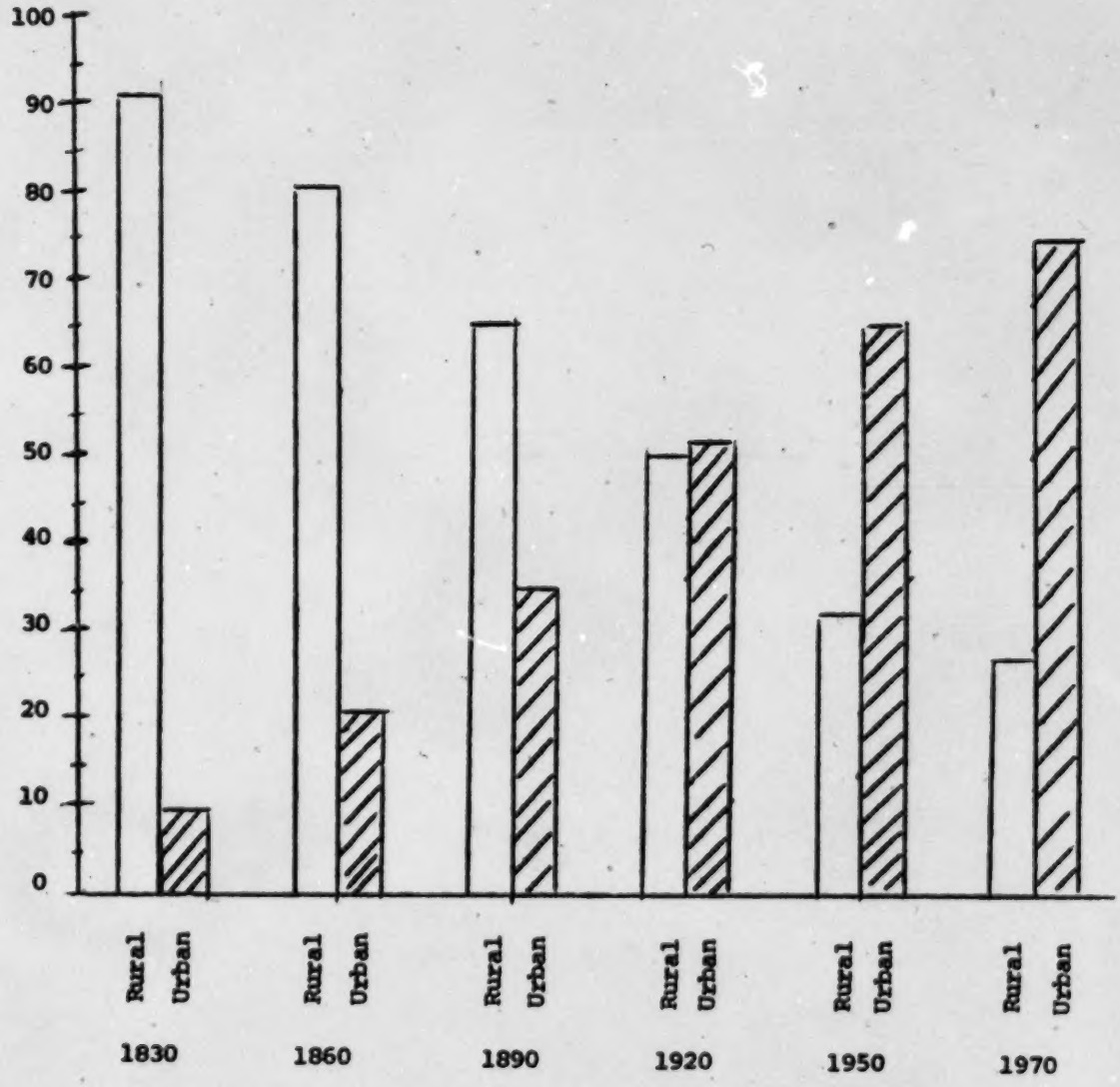
Have the class look for pattern - migration from rural areas, especially south, to city (if not children themselves, then often parents have migrated to city). Investigate possible reasons with the class. The class may conduct interviews at home or with neighbors to find more information here.

From this survey, have the class hypothesize as to distribution of population in the United States (more and more greater percentages of people are concentrating in urban areas).

Episode Ten

DISTRIBUTION: UNITED STATES

Where does most of the population live - Urban Areas or Rural Areas?



YEAR	RURAL	URBAN	TOTAL U.S. POPULATION
1830	12,000,000	1,000,000	13,000,000
1860	25,000,000	6,000,000	31,000,000
1890	41,000,000	22,000,000	63,000,000
1920	51,000,000	54,000,000	105,000,000
1950	54,000,000	97,000,000	151,000,000
1970	54,000,000	149,000,000	203,000,000

The above figures taken from Kathryn Horsley, Environment and Population, National Education Association, Washington D.C., 1972, p. 54.

THE URBANIZING UNITED STATES
(1800-1970)

YEAR	URBAN	%	RURAL	%	TOTAL
1800	300,000	6	5,00,000	94	5,300,000
1830	1,000,000	9	12,000,000	91	13,000,000
1860	6,000,000	20	25,000,000	80	31,000,000
1890	22,000,000	35	41,000,000	65	63,000,000
1920	54,000,000	51	51,000,000	49	105,000,000
1950	97,000,000	64	54,000,000	36	151,000,000
1970	149,000,000	74	54,000,000	26	203,000,000

Episode Ten

Checking the hypothesis - on overhead, show the graph of urban-rural percentages. Discuss the historical trend, immigration to cities.

Following Through:

Seventy percent of the people in the United States live on 2% of the land. The remaining 30% of the people live on 98% of the land.

Have the pupils mark off a 10 by 10 square on graph paper. Mark off two squares. Put 70 dots in those squares (i.e., 70% of the people on 2% of the land). Put 30 dots on the remaining area (98 squares). Explain percentage (i.e., 70% of the people would mean 70 out of every 100 people).

With the United States map, brainstorm and list with the class, possible reasons for this distribution. (Non-usuable areas: deserts, mountains. Attraction of cities and coasts. Land needed in farming, hence smaller number of people can live there.

World densities - Baltimore County and City densities are included for possible discussion.

POPULATION DENSITY OF THE CONTINENTS

Estimated number of persons per square mile in 1972.

Population	Continent	Persons per sq. mile
659,000,000	Europe	162
2,173,000,000	Asia	128
329,000,000	North America	35
370,000,000	Africa	32
201,000,000	South America	29
13,000,000	Australia	4

(Antarctica has no permanent population)

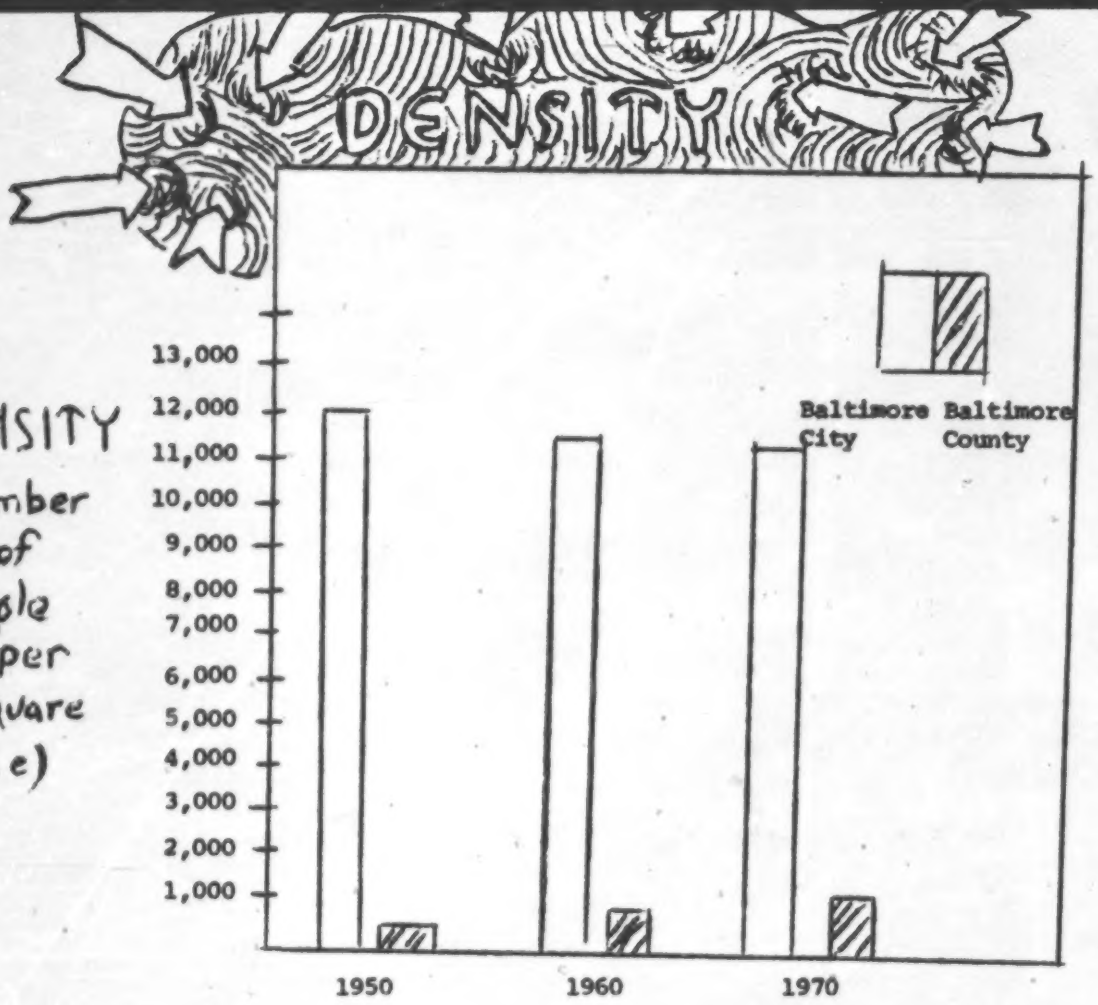
Source: Statistical Yearbook, 1969, U.N.

DENSITIES OF MAJOR LAND AREAS

LAND AREA	NUMBER OF PEOPLE PER SQUARE MILE
Asia	193
Africa	30
North America	34
South America	28
Europe	243
Oceania	6
USSR	28
World	62

Source: 1973 Information Please Almanac

Pupils might want to use this Almanac to research the densities of various countries and to find the most dense and the least dense, etc.



	NUMBER OF PEOPLE PER SQUARE MILE
Baltimore City	
Baltimore County 1950	
Baltimore City	
Baltimore County 1960	
Baltimore City	
Baltimore County 1970	

= 1,000 People

34

EPISODE ELEVEN

Unit: Population - Demography: Investigating Population Growth, Composition, Trends, and Changes

Topic: Doing the Demography - Age Structure

Objective: Pupils should be able to define "age structure", conduct a census of a given area and graph data from census.

Materials:
1. graph paper or story paper
2. transparency - graphs of India and Sweden

Discussion

This episode focuses on the age structure of a population and some of its implications. Age structure refers to the number of people within various age grouping i.e., the number of people, 0-4, 5-9, 10-14, 15-19, etc. For example, if the age structure shows a large number of children 0-4 years in age, then it will be necessary for the society to immediately begin planning and constructing schools to accomodate those children as they become older.

Another important consideration in which age structure is important is the ratio of dependent population to productive population. In the United States, it seems fair to consider those persons under 20 as dependent upon parents and society for support (monetary, educational, etc.) It also seems fair to consider those over 65 as dependent. Those from 20 to 65 may be considered as productive in terms of taxes, care, services, etc. These people usually can work to support themselves and their families, if they have them. Obviously, the more productive people there are in relation to dependent people, the more people-resources the society has to cope with problems and to expand on the dependent population (education, health care, social programs, etc.) On a personal level, an analogy may be made in the following terms. Family A consists of a husband and wife and two children. Family B consists of a husband and wife, an 85 year old grandmother, and four children. Family B has a higher ratio of dependency. As a result, if family A and B have the same income, family B will probably have a much more difficult time meeting its resource needs.

The age structure can also show how fast a population is growing. Compare the age structure graphs for India and Sweden. The disproportionately large number of young people shown by the graph on India shows that the population is growing rapidly now and will continue to grow as this large number of young people reach maturity and have children. The graph on Sweden, on the other hand, shows a very slowly growing population, with the number of people in each age group quite similar. In short, the Swedish are basically quite close to simply replacing themselves. (We remember that the growth rate is a function of the number of births, deaths, and net migration. Of course, a high birth rate will not necessarily indicate a high rate of growth unless the death rate is considerably lower than the birth rate.)

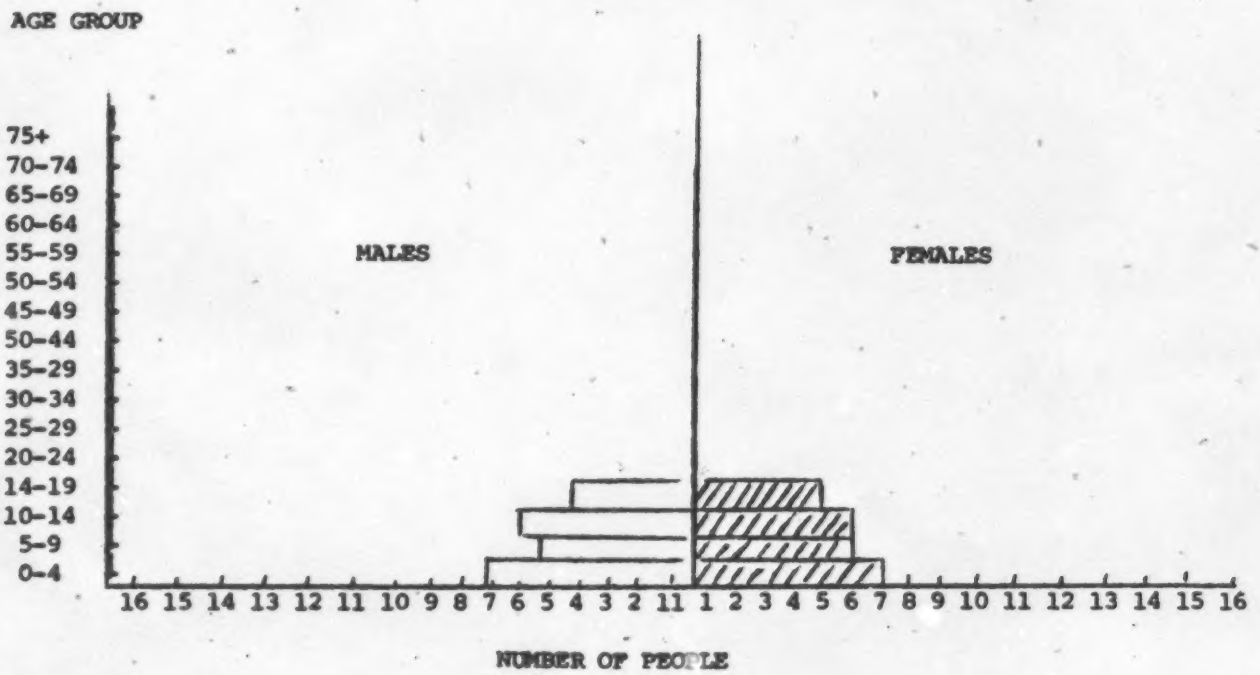
Beginning:

Students select one block near home or teacher selects one block near school for each class as the basis for making an age structure graph. Have the class do a census of the block, recording age group for each inhabitant. (See attached sheet) The "Census taker" puts in a mark in each age group for each person of that age group that he counts. Divide the block into smaller units and assign census taking for these smaller units to groups in the class.

After the pupils have conducted the census, collect all data for the block and put on one sheet.

Continuing:

Now the class is ready to make an age structure graph. This may be put on story paper. The graph should look something like this.



Episode Eleven

So far, the graph shows:

7 males - 0-4 years
7 females - 0-4 years
5 males - 5-9 years
6 females - 5-9 years
6 males - 10-14 years
6 females - 10-14 years
4 males - 15-19 years
5 females - 15-19 years

Your numbers may be larger.

Following Through:

When the graph is finished, discuss and record observations with the class.

What does age structure graph show about the block?
Any surprises?

Are there many young people? What effect does this have?

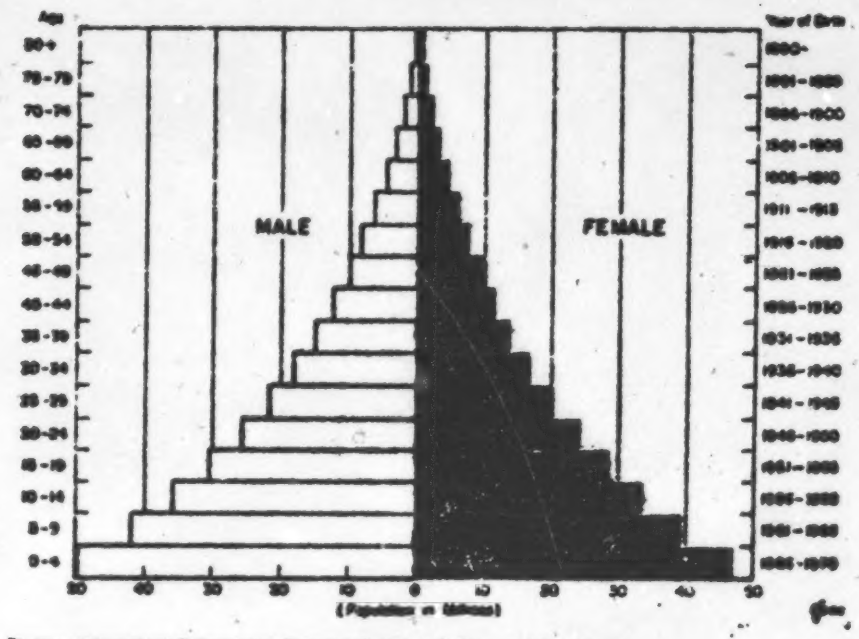
Is population growing?

What age groups have the most people? Why

What is the ratio of productive to dependent age groups?

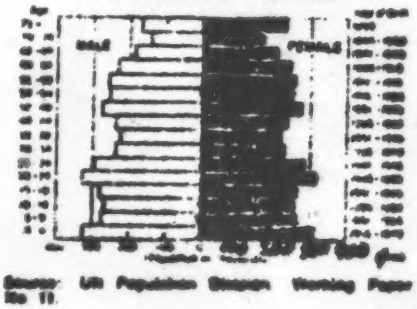
Show the graphs on India and Sweden. Which graph is more similar to your graph? Discuss with the class what is happening in India and Sweden from looking at the graphs. Also, note with the class that India's population is given in millions, while Sweden's is in thousands. In short, there are about 300,000 females aged 0-4 in Sweden while there are about 47,000,000 females aged 0-4 in India.

INDIA: 1970 POPULATION BY AGE AND SEX



Source: International Demographic Statistics Center, U.S. Bureau of the Census.

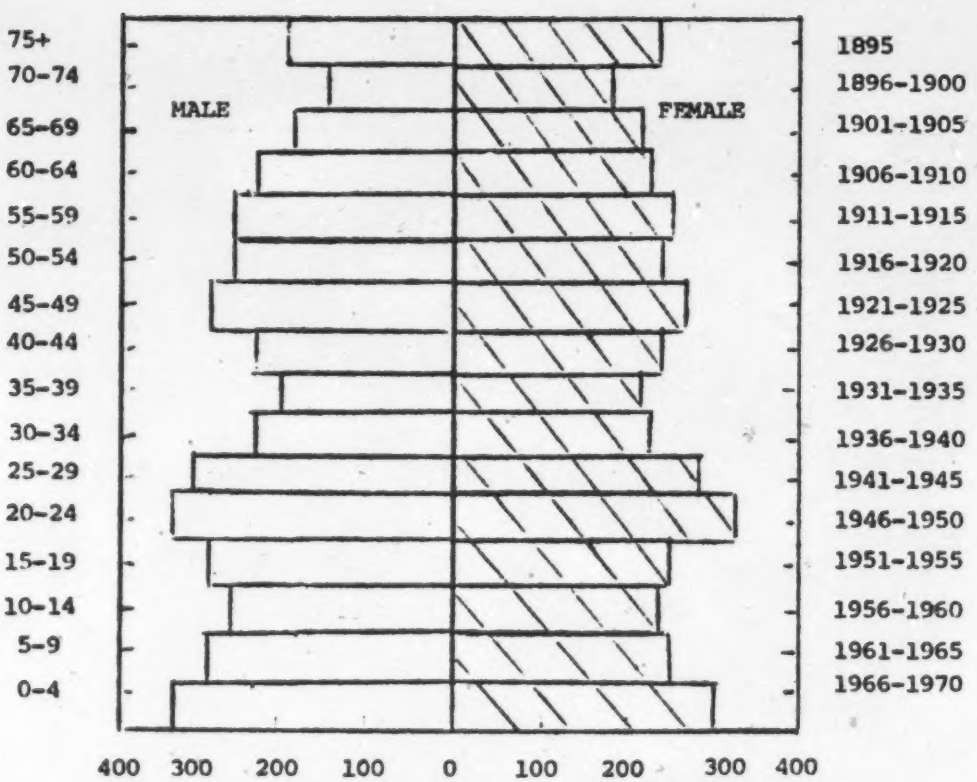
SWEDEN: 1970 AGE-SEX PYRAMID



Source: UN Population Division Working Paper

SWEDEN:

1970 AGE-SEX PYRAMID



Source: UN Population Division. Working Paper No. 11.

AGE STRUCTURE CENSUS SHEET

	MALES	FEMALES
0-4		
5-9		
10-14		
15-19		
20-24		
25-29		
30-34		
35-39		
40-44		
45-49		
50-54		
55-59		
60-64		
65-69		
70-74		
75+		

Note to Census Taker: For each house surveyed, put a mark (1) in the correct age group for each person who lives there. Don't forget to put males in the first column and females in the second column.

EPISODE TWELVE

Unit: Population - Demography: Investigating Population Growth, Composition, Trends, and Changes

Topic: Doing the Demography - Number of Children and Population Growth

Objective: Pupils should be able to observe and identify at least 2 consequences of different sizes of families on future population.

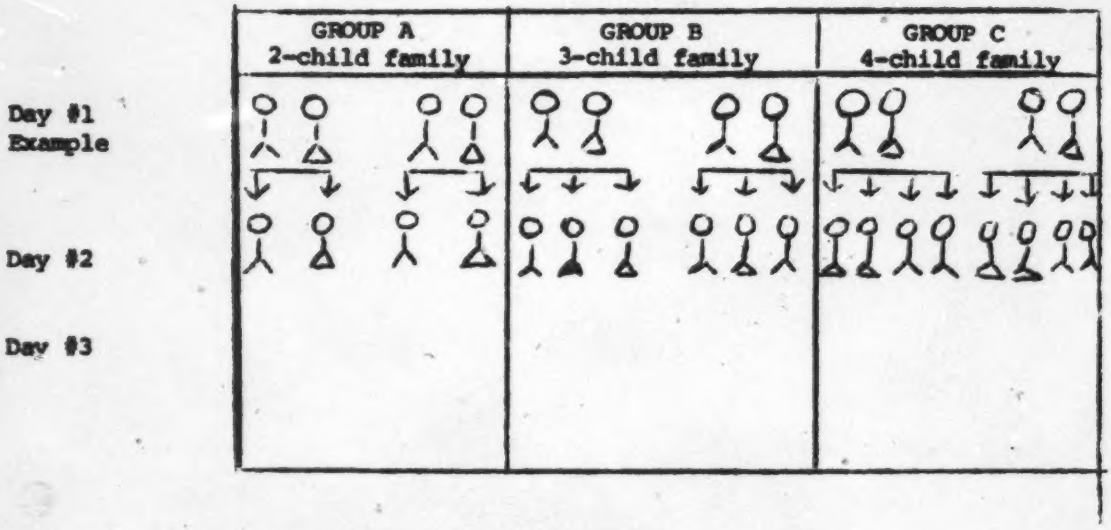
Materials: Magazine pictures of people

Discussion

This episode focuses on the idea that personal decisions have demographic consequences by examining the effect of two, three, and four child families on population growth. This lesson should be future-oriented, that is, the effect of future family size on future population growth. This lesson is not intended to set up a norm for family size, but only to observe the effects of different family sizes; that is, to provide information, not to encourage a specific decision.

Beginning:

Start off on the board with magazine cut-out pictures of people in three groups. Or you could have pupils do stick figure drawings and cut them out. Either way, have pupils supply the pictures. You will need thirty figures the first day. Arrange the board in the following way (figures should be in couples):



On Day #1, each couple in Group A has 2 children.
each couple in Group B has 3 children.
each couple in Group C has 4 children.

(Make more cut-outs)

Now find the total number of children for each group:

A-4
B-6
C-8

On Day #2, arrange the children from Day #1 into couples. Each couple then has children, the number of which depends on the group the couple is in.

Group A-2
Group B-3
Group C-4

(Make more cut-outs)

Now find the total number of children born into each group on Day #2.

A-4
B-9
C-16

On Day #3, arrange the children from Day #2 into couples and have each couple have children, the number of which again depends on the group to which the couple belongs. (Note: one person in Group B will have to remain unmarried-no children.)

Figure the total number of children for Day #3 for each group.

A-4
B-12
C-32

(On Day #3, you will obviously need many more cut-outs.)

Discuss with the class the effects of 2, 3, and 4 child families on population growth.

Have them explain as well as possible why the population grew so much faster with a four child family.

If you wish, go on to Day #4 and #5. Have the class make predictions. Pupils could also graph growth, showing population for Day #1, Day #2, etc.)

Have the class expain the results in terms of growth rate and population size. What is the "multiplier effect"?

Continuing:

Show the overhead graph - projections for U.S. in year 2000 for 2 and 3-child families.

POPULATION GROWTH AND FAMILY SIZE

The difference between a two-child family and a three-child family is tremendous over several generations. An average of three children per family will push U.S. population up to 400 million by the year 2014; the two-child family would mean 100 million less than that. In the next generation the difference would be even greater.